Memorandum

Flex your power!
Be energy efficient!

To: MR. MARK SOBOTA,
BRANCH CHIEF
NORTH REGION OFFICE OF DESIGN
DESIGN BRANCH E 1

Date: November 25, 2014

File: 01-MEN-01-PM 42.4/43.3
Salmon Creek Bridge
(Replacement)
EA 01-401401
ID 0100000155

Attention: Eric Lund, Project Engineer

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: **Geotechnical Investigation Plan (GIP) - Revised**
(Replaces GIP, dated November 7, 2014)

BACKGROUND

The Office of Geotechnical Design North (OGDN) has prepared this Geotechnical Investigation Plan for the replacement of the existing Salmon Creek Bridge on Route 01, PM 42.4/43.3 in Mendocino County. This (GIP) pertains to two alternative proposed bridge designs that are being considered at this time. The designs include a three span concrete steel reinforced conventional box girder structure (Alternative S2D-A) and a four span concrete steel reinforced arch structure (Alternative S2D-B). The preferred bridge alignment is located on the east side of the existing bridge. The purpose of this memorandum is to provide details regarding the proposed geotechnical design investigation. These details include:

1. Drill site description, planned alteration and earthwork quantities
2. Drilling operations.
3. Site environmental precautions.
4. Seismic refraction survey.
5. Site restoration.

Refer to the attached Geotechnical Exploration Plan (Appendix A) that delineates the planned drill sites and access routes. Note that it is planned that ground alterations and related vegetation removals and/or trimming will be confined to the designated drill site and access areas.

DRILL SITE DESCRIPTION AND PLANNED ALTERATIONS

Drill Site 1 (Sta. 130+40)

Structure Alternatives S2D-A and S2D-B - Abutment 1

Access will be from Highway 1 at approximately Station 130+40. Temporary removal of guard railing will be required. The site terrain ranges from flat to moderately steep. Cut and fill grading will be necessary to connect and restore an existing access road to all drill sites. Vegetation is sparse to moderately dense and consists mainly of underbrush and grass. Vegetation removal will be required. A rubber tired truck mounted drill rig can be used under dry conditions otherwise all-terrain drill rigs will be required. The estimated depth of the boring is approximately 70 to 80 feet.

Over head utility lines pass above the drill site and access road. A Utility pole is located about 20 ft south of drill pad.

Drill Site 2 (Sta. 131+85)

Structure Alternative S2D-B - Pier 2

Access will be from Highway 1 at approximately Station 130+40. A spur constructed off the main access road will be necessary to reach Site 2. The terrain is flat and steep. Cut/fill grading will be required to build the spur and drill pad. Brush removal will be necessary. Vegetation consisting of mainly dense brush covers the site. Depending on ground conditions either a rubber tire or track mounted drill rig will be used. The estimated depth of the boring is approximately 100 to 120 feet. Over head utility lines pass over this drill site.

Drill Site 2 (Sta. 132+85)

Structure Alternative S2D-A – Pier 2

Access will be from Highway 1 at approximately Station 130+40. The terrain at the site is relatively gentle 3:1 (horizontal: vertical). Minor cut fill grading will be required to create an adequate sized and level drill pad. Vegetation is moderately dense and consists mainly of underbrush and grass. Brush removal will be necessary. Depending on ground conditions either a rubber tire or track mounted drill rig will be used. The estimated depth of the boring is approximately 120 to 150 feet. Over head utility lines pass over the east edge of site.

Drill Site 3 (Sta. 133+65)

Structure Alternative S2D-B – Pier 3 (Inclined Shaft)

The site can be reached from Highway 1 at approximately Station 130+40. Take the prepared access road that intersects the Highway and follow to the drill site. The site terrain is moderately steep. Cut fill grading will be required to create an adequate sized and level drill pad. Vegetation is moderately dense and consists mainly of brush and grass. Brush removal will be necessary. Depending on ground conditions either a rubber tire or track mounted drill rig will be used. The estimated depths of the inclined boring are approximately 80 to 100 feet. To assess the excavation conditions of the proposed inclined shafts a seismic refraction survey will be performed.

Drill Site 3 (Sta. 136+10)

Structure Alternative S2D-A – Pier 3

Access will be from Highway 1 on to Spring Grove Road (SGR). Follow SGR to drill site (Refer to Geotechnical Exploration Plan). The terrain at the site is nearly level. Grading will not be required. Vegetation is very sparse consisting of a patchy distribution of bushes and grass. A rubber tire truck mounted drill rig will be used. The estimated depths of the boring are approximately 120 to 150 feet or more depending in part on the depth of the underlying alluvial deposits.

Drill Site 4 (Sta. 137+25)

Structure Alternative S2D-B – Pier 4 (Inclined Shaft)

Access will be from Highway 1 on to Spring Grove Road (SGR). Follow SGR to drill site (Refer to Geotechnical Exploration Plan). The terrain at the site is steep (1:1, horizontal: vertical). Minor grading will be required to temporarily widening SGR (staging location) above the drill site. This will be done by removing and flattening the outside shoulder berm and dressing up the inside shoulder. The drill site area (slope) as shown contains a dense concentration of generally brush and saplings. To get equipment and personnel down to the drill sites, an approximately 15 foot wide path would be created by cutting the vegetation within to just above ground level. At the boring locations, an approximate 20 x 30 ft area would require similar vegetation trimming to facilitate construction of a level steel platform on which the drilling operations will be performed. Alternatively, if the contractor elects to use a self-leveling track mounted drill the vegetation trimming area will be similar in size. Support equipment will be located on the shoulder of Spring Grove Road and/or at Drill Site 5. If support vehicles are located on Drill Site 5 an approximately 2 to 3 foot path would have to be cut down slope to Drill Site 4 to facilitate getting fluid hoses to the drill rig. The estimated length of the inclined boring is approximately 150 feet. The depth of the up slope vertical boring will be about 125 feet. To assess the excavation conditions of the proposed inclined shafts a seismic refraction survey will be performed. Overhead utility line passes

over the site generally east to west.

Drill Site 4 and Drill Site 5 (Sta. 138+75)

Structure Alternative S2D-A – Abutment 5 and Structure Alternative S2D-B – Abutment 4

Access will be from Highway 1 at approximately Station 138+75. Temporary removal of guard railing will be required. Follow prepared access road (old State highway) to drill sites. The site terrain is rough in spots but generally flat. A patchy distribution of brush and small trees cover the site. The intent is to remove the brush and trees on the north half of the site (flat area) to allow for drill equipment and support vehicles. As indicated above, if this drill site is used as a staging area for Alternative S2D-B, Drill Site 4, an approximately 2 to 3 foot wide de-brushing of the slope between the two drill sites would be required. The depth of the borings will be about 70-90 feet. Overhead utility lines pass over the northeast corner of the site.

Drill Sites 5, 6 and 7 Alt. S2D-A; Drill Sites 6, 7and 8 Alt. S2D-B (Sta. 139+26 to Sta. 143+76)

Retaining Wall

Access will be from Highway 1 at approximately Station 145+00. The terrain is relatively flat along the wall alignment (Grade variation of about 4 feet over a distance of 450 feet).
It appears that there is a patchy distribution of grass and low brush along the alignment. A rubber tire truck mounted drill rig should be able to reach the drill sites under dry conditions. However, a site visit by drilling services personnel will be required to assess the sites access conditions. Three vertical are proposed. The approximate locations of the borings are shown on the attached plan. The estimated depth of the vertical borings is approximately 35 feet. As an option a seismic refraction survey may be performed to further assess the excavation conditions along the wall alignment.

There is an overhead utility line that pretty much follows the proposed wall alignment. Therefore, the borings will not necessarily be sited on the wall alignment (A 25 foot minimum distance between the utility line and the drill rig mast that must be maintained).

Site 7 (Sta. 124+00 to Sta. 128+00 and between Sta. 130 and Sta. 139)

Cut Slopes and Natural Slope areas

To evaluate the excavation condition stability of the proposed referenced areas geophysical surveys are recommended. This site appears to contain a row of trees including some brush and grass. The seismic lines will be located approximately as shown on the attached plans. To facilitate

the placement of the geophone arrays a discontinuous narrow swath (12 to 24 inches approximately) of brush may be removed depending on the density of the vegetation cover. No other significant disturbance of the ground is anticipated (See geophysical survey section below).

DRILLING OPERATIONS

The drill equipment will include a track mounted All-Terrain drill rigs, a self-leveling track mounted rig and on flat sites a truck mounted rig. Also, on the steepest slopes a steel level platform will be constructed that will support the drill equipment. Support vehicles for both rig types include an equipment/water tender, drill crew cab, trailer and geologist/engineer vehicles. The drilling and sampling will be done using a self-casing rotary wash wire-line system with drill pipe diameters of 94-mm and 114-mm. The boring depths have been previously noted. Drilling fluids consisting of water mixed with bentonite and/or polymer that will be re-circulated through a closed system that includes drill pipe, pump, hoses and a mud tank. After completion of the drilling the drill cuttings and fluids will be pumped into 55 gallon drums and transported to Transportation Laboratory in Sacramento for processing. After the drilling fluids removal a combined slope inclinometer /piezometer will be installed in each boring to monitor ground movement and changes in groundwater elevations.

Future boring abandonment: The Geotechnical Borings will be abandoned in compliance with County boring permit requirements and Geotechnical Services (GS) Directive GS-01.

EARTHWORK QUANTITIES

Earthwork quantities that were generated during grading the access roads and drill sites are presented in attachment, Appendix B.

GEOPHYSICAL SURVEYS

Geophysical surveys integrated with the geologic data will be employed to evaluate geology, ground stability and excavations conditions of the site. The type of surveys that maybe utilized includes seismic refraction and refraction tomography surveys.

The locations of the seismic lines and designated geophysical borings are shown on the Geotechnical Exploration Plan attached. The field work with a crew of three will take approximately 10 working days to complete. Field data reduction, modeling and report preparation will take approximately three to four weeks. See Appendix C for Seismic Refraction Survey operation details and environmental impacts.

ENVIRONMENTAL PRECAUTIONS

Precautions during drilling will be employed to mitigate any possible equipment leaks or drilling fluid spillage. They may include plastic tarps, absorption mats and jute waddles. Contained drill fluids generated during drilling will be pumped in to 55-gallon steel drums and transported Caltrans facilities for processing.

SITE RESTORATION

Ground conditions altered due to work activities, will be restored and/or protected utilizing Best Management Practices (BMP). The BMP restoration will include but limited to remedial grading, re-seeding, and placement of straw and jute waddles. The design investigation will occur over several months. During that time the sites environmental protections will be periodically monitored to insure their performance.

If more information and/or clarifications are needed, please contact William Bertucci at 916.203.7992 or John Huang at 916.916.1037.

WILLIAM BERTUCCI
Associate Engineering Geologist
Office of Geotechnical Design North
Division of Engineering Services

Signed for John HB
JOHN HUANG
Materials and Research Engineer
Office of Geotechnical Design North
Division of Engineering Services

Attachment: Appendix – A: Geotechnical Exploration Plan
Appendix – B: Earthwork Quantities
Appendix – C: Seismic Survey operations and Environmental Impacts

c:

FDemling	District Project Manager
KHallis	Structure Maintenance
KWaxman	Right of Way
MSobota	District Design Branch Chief
ELund	District Design- Project Engineer
RHaralson	Surveys
APommerenck	Environmental
JHaney	Cultural
CPitts	Community Impact Study

APPENDIX – A
Geotechnical Investigation Plans

Bridge Design Alternative S2D-A

Bridge Design Alternative S2D-B

Bridge Design Alternative S2D-A

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
01	MEN	1	42.4/43.3	1	3

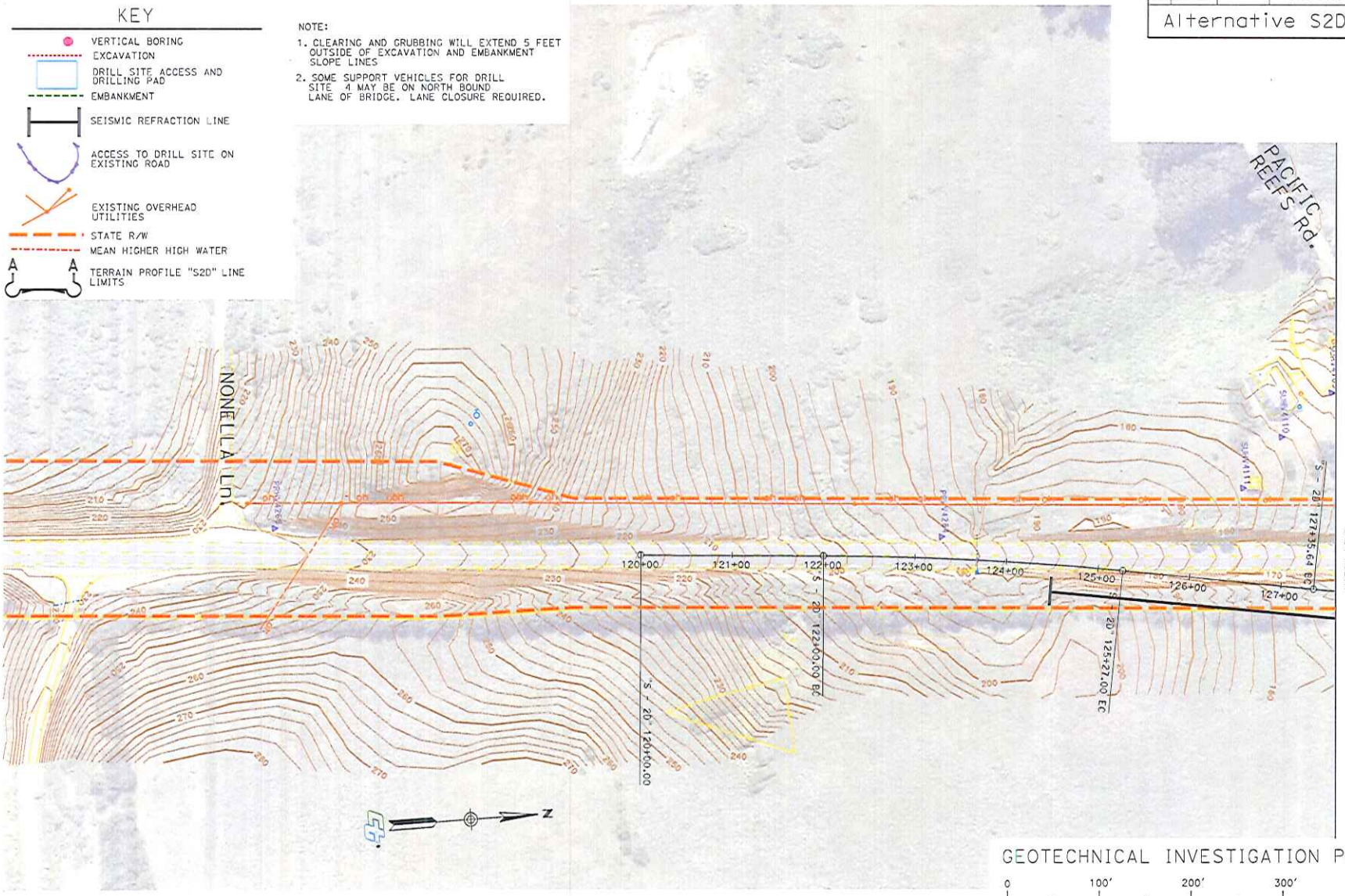
Alternative S2D-A

KEY

- VERTICAL BORING
- EXCAVATION
- DRILL SITE ACCESS AND DRILLING PAD
- EMBANKMENT
- SEISMIC REFRACTION LINE
- ACCESS TO DRILL SITE ON EXISTING ROAD
- EXISTING OVERHEAD UTILITIES
- STATE R/W
- MEAN HIGHER HIGH WATER
- TERRAIN PROFILE "S2D" LINE LIMITS

NOTE:

1. CLEARING AND GRUBBING WILL EXTEND 5 FEET OUTSIDE OF EXCAVATION AND EMBANKMENT SLOPE LINES
2. SOME SUPPORT VEHICLES FOR DRILL SITE 4 MAY BE ON NORTH BOUND LANE OF BRIDGE. LANE CLOSURE REQUIRED.



GEOTECHNICAL INVESTIGATION PLAN

0 100' 200' 300'

SCALE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR: Mark Sabala

CALCULATED-DESIGNED BY: Eric Lund

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DATE REVISED

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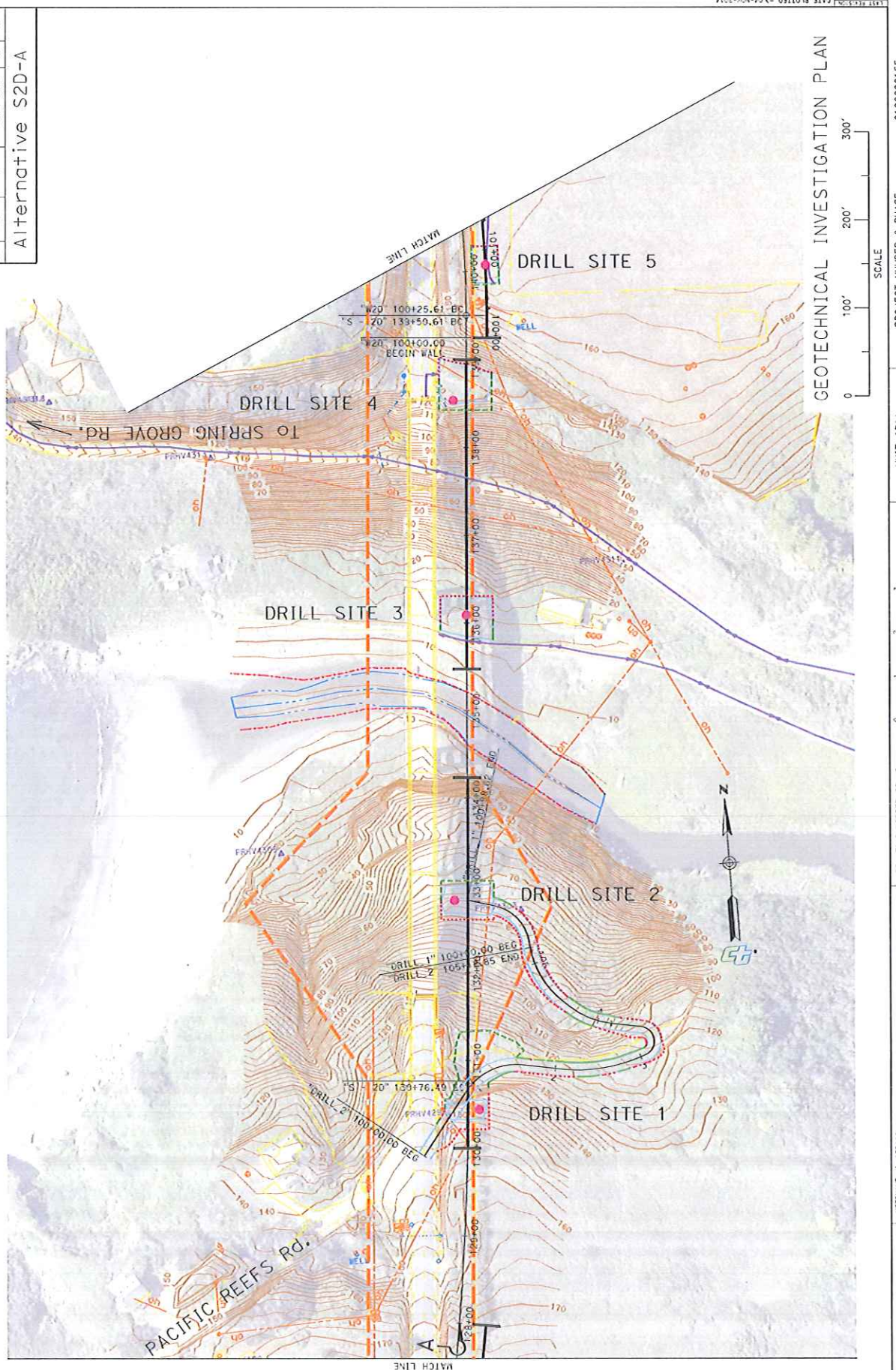
UNIT 0311

PROJECT NUMBER & PHASE 0100000155


GEOTECHNICAL INVESTIGATION PLAN
SCALE
0
100'
200'
300'
DRILL SITE 5
DRILL SITE 4
DRILL SITE 3
DRILL SITE 2
DRILL SITE 1
TO SPRING GROVE RD.
PACIFIC REEFS Rd.
MATCH LINE
MATCH LINE
N
A
A'
DRILL 1" 100+00.00 BEG
DRILL 2 105+85 END
DRILL 2 100+00.00 BEG
"S - 20" 133+76.49 EB
"W20" 100+25.61 BC
"S - 20" 133+50.61 EC
"W20" 100+00.00
BEGIN WALL
D1&P 01
COUNTY MEN
ROUTE 1
PROJ TOTAL 42.4/43.3
SHEET NO. 2
TOTAL SHEETS 3
Alternative S2D-A
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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
FUNCTIONAL SUPERVISOR
Mark Sobota
CALCULATED-DESIGNED BY
Eric Lund
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DATE REVISED
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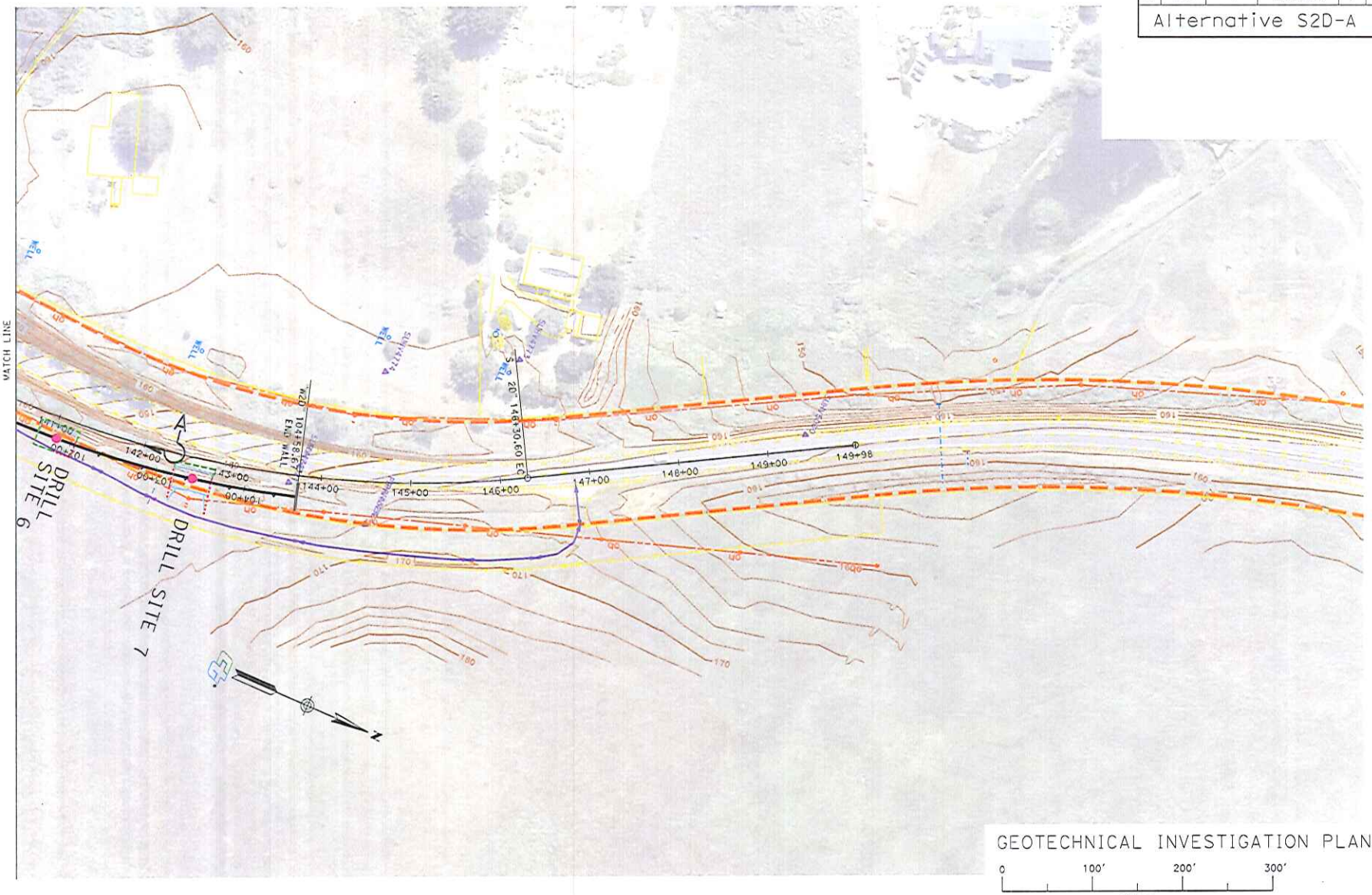
DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
01	MEN	1	42.4/43.3	3	3

Alternative S2D-A



GEOTECHNICAL INVESTIGATION PLAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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UNIT 0311
PROJECT NUMBER & PHASE 0100000155

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
01	MEN	1	42.4/43.3	1	2

Alternative S2D-A

TERRAIN PROFILE "S - 2D" LINE

GEOTECHNICAL INVESTIGATION PLAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR: Mark Sabato

CALCULATED-DESIGNED BY: Eric Lund

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DATE REVISED

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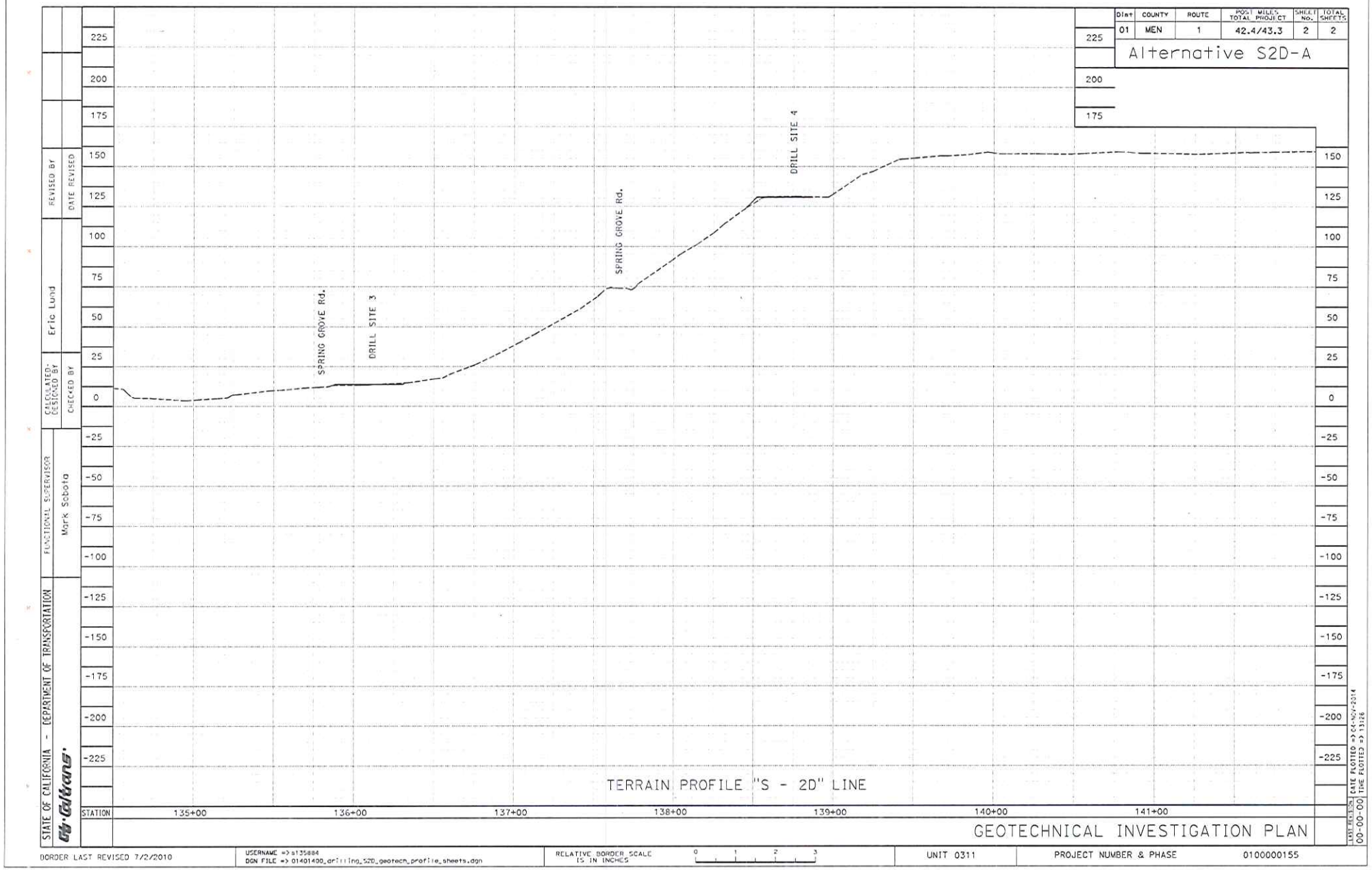
PROJECT NUMBER & PHASE 0100000155



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01	MEN	1	42.4/43.3	2	2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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FUNCTIONAL SUPERVISOR: Mark Sabota

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UNIT 0311

PROJECT NUMBER & PHASE 0100000155

Bridge Design Alternative S2D-B

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
01	MEN	1	42.4/43.3	1	3

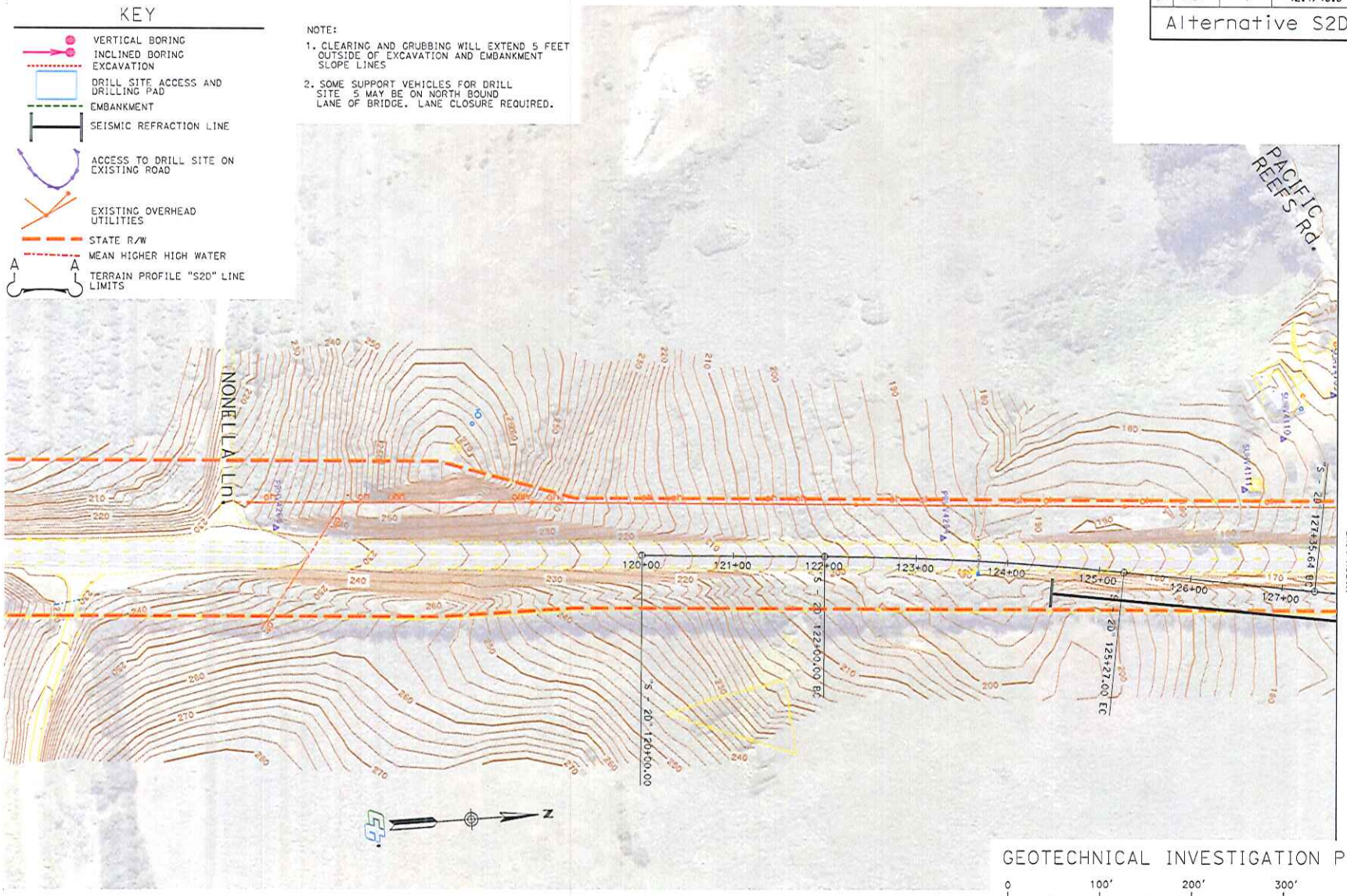
Alternative S2D-B

KEY

- VERTICAL BORING
- INCLINED BORING
- EXCAVATION
- DRILL SITE ACCESS AND DRILLING PAD
- EMBANKMENT
- SEISMIC REFRACTION LINE
- ACCESS TO DRILL SITE ON EXISTING ROAD
- EXISTING OVERHEAD UTILITIES
- STATE R/W
- MEAN HIGHER HIGH WATER
- TERRAIN PROFILE "S2D" LINE LIMITS

NOTE:

1. CLEARING AND GRUBBING WILL EXTEND 5 FEET OUTSIDE OF EXCAVATION AND EMBANKMENT SLOPE LINES
2. SOME SUPPORT VEHICLES FOR DRILL SITE 5 MAY BE ON NORTH BOUND LANE OF BRIDGE. LANE CLOSURE REQUIRED.



GEOTECHNICAL INVESTIGATION PLAN

0 100' 200' 300'

SCALE

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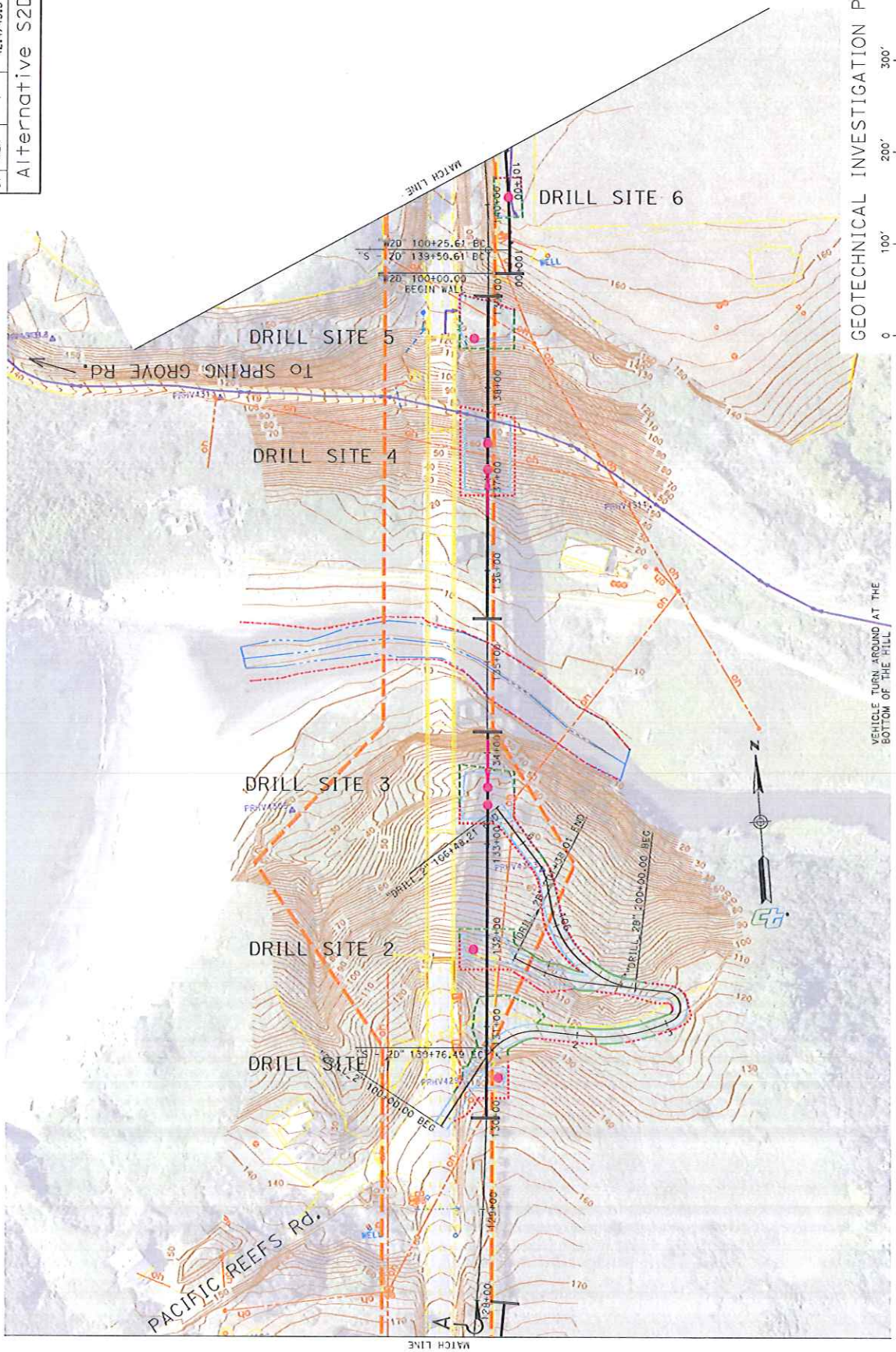
PROJECT NUMBER & PHASE 0100000155



Dist	COUNTY	ROUTE	POST MILLS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
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Alternative S2D-B

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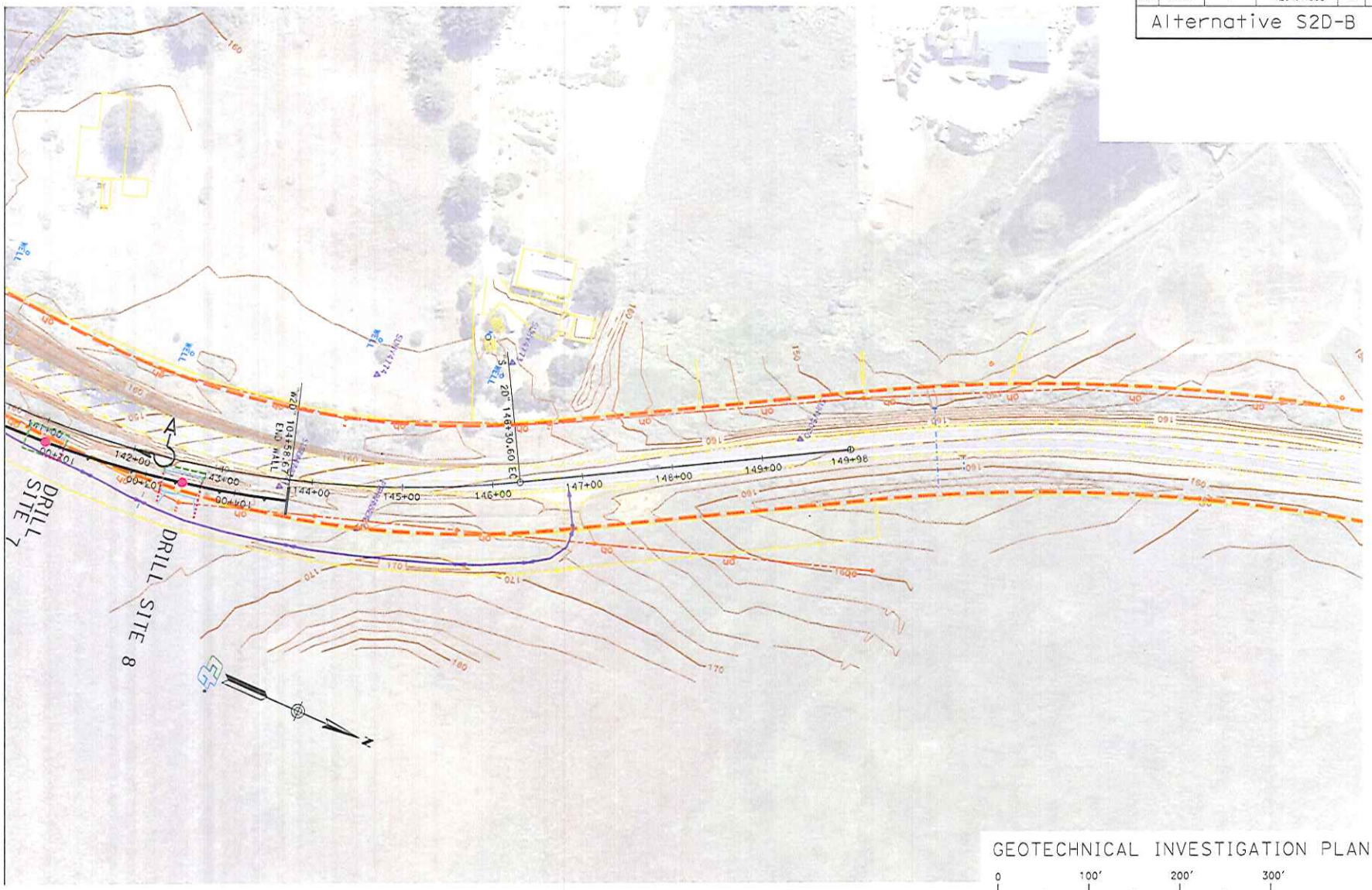
Alternative S2D-B



GEOTECHNICAL INVESTIGATION PLAN

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PROJECT NUMBER & PHASE 0100000155

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	1	42.4/43.3	1	2

Alternative S2D-B

TERRAIN PROFILE "S - 2D" LINE

GEOTECHNICAL INVESTIGATION PLAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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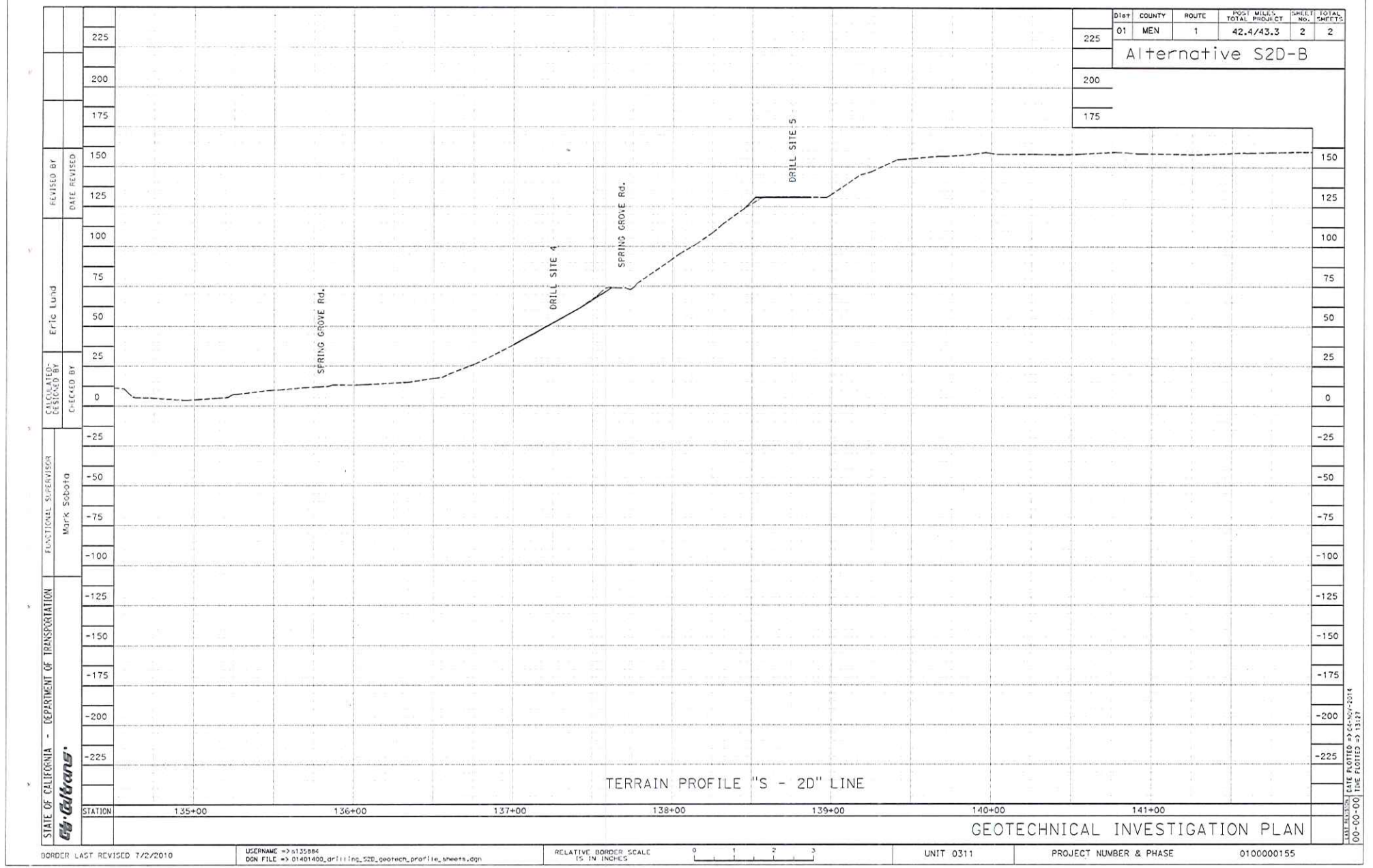
UNIT 0311

PROJECT NUMBER & PHASE 0100000155



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01	MEN	1	42.4/43.3	2	2

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FUNCTIONAL SUPERVISOR: Mark Sabota

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GEOTECHNICAL INVESTIGATION PLAN

BORDER LAST REVISED 7/2/2010

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UNIT 0311

PROJECT NUMBER & PHASE 0100000155

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APPENDIX – B

Earthwork Quantities

ALTERNATIVE S2D-A GEOTECHNICAL INVESTIGATION EARTHWORK QUANTITIES

ALIGNMENT/SITE	STATION	EXCAVATION	EMBANKMENT	NET (EXCAVATION-EMBANKMENT)
		CY	CY	CY
DRILL_1	100+00.00 - 100+98.62	70	17	53
DRILL_2	100+00.00 - 105+18.85	379	296	83
DRILL SITE 1	N/A	125	6	119
DRILL SITE 2	N/A	111	122	-11
DRILL SITE 3	N/A	22	22	0
DRILL SITE 4	N/A	35	35	0
DRILL SITE 5	N/A	10	10	0
DRILL SITE 6	N/A	6	6	0
DRILL SITE 7	N/A	25	25	0
	TOTAL	783	539	244

ALTERNATIVE S2D-B GEOTECHNICAL INVESTIGATION EARTHWORK QUANTITIES

ALIGNMENT/SITE	STATION	EXCAVATION	EMBANKMENT	NET (EXCAVATION-EMBANKMENT)
		CY	CY	CY
DRILL_2	100+00.00 - 106+48.21	500	297	203
DRILL_2b	200+00.00 - 201+38.01	90	101	-11
DRILL SITE 1	N/A	125	6	119
DRILL SITE 2	N/A	130	130	0
DRILL SITE 3	N/A	155	155	0
DRILL SITE 4	N/A	20	20	0
DRILL SITE 5	N/A	35	35	0
DRILL SITE 6	N/A	10	10	0
DRILL SITE 7	N/A	6	6	0
DRILL SITE 8	N/A	25	25	0
	TOTAL	1096	785	311

ALTERNATIVE S2D-A & S2D COMBINED GEOTECHNICAL INVESTIGATION EARTHWORK QUANTITIES

ALIGNMENT/SITE	STATION	EXCAVATION	EMBANKMENT	NET (EXCAVATION-EMBANKMENT)
		CY	CY	CY
DRILL_1	100+00.00 - 100+98.62	70	17	53
DRILL_2	100+00.00 - 106+48.21	500	297	203
DRILL_2b	200+00.00 - 201+38.01	90	101	-11
S2D-A&BDRILL SITE 1	N/A	125	6	119
S2D-A DRILL SITE 2	N/A	111	122	-11
S2D-B DRILL SITE 2	N/A	130	130	0
S2D-A DRILL SITE 3	N/A	22	22	0
S2D-B DRILL SITE 3	N/A	155	155	0
S2D-A DRILL SITE 4 & S2D-B D	N/A	35	35	0
S2D-B DRILL SITE 4	N/A	20	20	0
S2D-A DRILL SITE 5 & S2D-B D	N/A	10	10	0
S2D-A DRILL SITE 6 & S2D-B D	N/A	6	6	0
S2D-A DRILL SITE 7 & S2D-B D	N/A	25	25	0
	TOTAL	1229	929	353

APPENDIX – C

Seismic Survey operations and Environmental Impacts

APPENDIX – C

Seismic Refraction Surveys and Environmental Impacts

This document summarizes typical scope and environmental impacts posed by seismic refraction surveys conducted for the Department of Transportation.

General Description of Work

Geophones (small 2 inch square sensors on a 3 inch long, by 2 inch diameter spike) are inserted into the ground at specific intervals (3 to 10 feet typical) and connected to a cable that is in turn attached to a battery-powered seismograph.

Geophones record vibratory impulses generated by active sources. Three types of sources are used and are listed in order of increasing power: hammer and striker-plate, down-hole shotgun, and explosive. The number of source locations used on a typical seismic line varies from 5 to 20, depending on required resolution.

Survey locations are selected based on the goals of the investigation, safety requirements and access restrictions imposed by environmental and entry permits. Access to survey locations may be by motor vehicle or by foot, again depending on access restrictions.

Environmental Impacts

Site Access

Site access is by motor vehicle or by foot, depending on access restrictions. When used, motor vehicle access is limited to existing roads and trails. Motorized or non-motorized boats may be used for water access, depending on depth of water and access restrictions.

Hours of Work

All work is conducted during daylight hours from Monday through Friday. Exceptions occur during stated emergencies only.

Equipment Storage

Unless placed in a designated and secure construction area, no equipment is stored on-site. All equipment is portable and secured in vehicles when not in use.

Footprint and Area of Related Ground Disturbance

24 or more geophones (small 2" square sensors on a 3"spike) are planted at the ground surface. The geophones are removed after work is completed. The spike is approximately 12-inch in diameter, and leaves no lasting impression in the ground surface. Ground and vegetation disturbance is isolated to foot-traffic areas and locations where the sources are

employed. (Additional discussion of source effects is provided below). The extent of source disturbance at the ground surface increases with source strength. Typical maximum disturbance consists of a circular area of raised earth approximately 5 feet in diameter centered over the source's original location. An effort is made to conceal disturbed brush and tamp down disturbed soil to return it to its original condition. Minor brush cutting is occasionally required for access and is minimized wherever possible. Effort is made to restore visual impacts at the conclusion of the survey.

Source Effects

Three types of sources are used and are listed in order of increasing energy: hammer and striker plate, clown-hole shotgun, and explosive. The number of source locations used on a typical seismic line varies from 5 to 20, depending on required resolution.

The hammer and striker plate source consists of a 12- to 16-lb sledgehammer struck against a small metal plate placed on the ground. This creates the least ground disturbance (a dent or divot in ground in the shape of the plate). Contrary to expectation, however, this source typically creates the greatest noise. The "ping" from the hanmler striking the plate may exceed 120 dB in the vicinity of the operator, so hearing protection is required when operating this source.

The down-hole shotgun uses an industrial shell fired in a 1.5-foot deep water-filled hole. The hole is created by manually driving a 2 by 2-inch diameter gad bar into the ground. The industrial shell is an 8-gauge 350- to 500-grain blank shotgun cartridge. Shells are typically triggered approximately 20 minutes apart. Shot gun detonations may leave an area of disturbed earth up to 2 feet in diameter. An effort is made to tamp down the soil to return it to its original condition. There are no appreciable effects on flora or fauna outside that diameter. Detonation of the shells occurs below ground and does not pose a fire hazard. With well-prepared shot holes, the highest anticipated noise generated consists of a muffled "thump" of approximately 60 dB. More often than not, the fired shells are barely audible.

Small explosive charges may also be employed. All work related to explosives is conducted by licensed blasters. When used, the charges are placed below the ground surface in a 1.5- to 3-foot deep hole. The hole is created by manually driving a 2 by 2-inch diameter gad bar into the ground. The charge is placed in the hole and the hole is then backfilled. The charge is detonated by means of an electric cap. Charges are typically triggered approximately 30 minutes apart. With well-prepared shot holes, the highest anticipated noise generated during detonation is an approximately 60-80 dB muffled "thump". More often than not, the detonations are barely audible. The extent of disturbed ground post-detonation consists of a circular area of raised earth up to 5 feet in diameter and centered over the original charge. An effort is made to tamp down the soil to return it to its original condition. There are no appreciable effects on flora or fauna outside that diameter. The charges are detonated down hole and do not pose a fire hazard.